

TORREYA

Vol. 28

No. 2

March-April, 1928

REVEGETATION OF BEECH-MAPLE AREAS IN THE
DOUGLAS LAKE REGION*

MARJORIE L. WOOLLETT AND DOROTHY SIGLER

The Douglas Lake region, Cheboygan Co., Michigan, lies in a transition zone between the northeastern coniferous forests and the central deciduous forests. There are many well-drained ridges or moraines in this region that are or have recently been covered by a virgin beech-maple forest.†

Typical trees are: *Acer saccharum*, *Betula lutea*, *Fagus grandifolia*, *Tilia glabra* and *Ulmus americana*. Where trees have fallen, opportunity is given to the many seedlings which soon fill such open places to replace the old trees. Most prominent among the few shrubs in the beech-maple forests are *Sambucus racemosa*, *Ribes cynosbati*, and *Lonicera canadensis*. Of the ground plants, the first or vernal cycle is composed largely of bulbous plants or plants from rootstocks, *Viola canadensis*, *Allium tricoccum*, *Bicuculla canadensis*, *Bicuculla cucullaria*, *Erythronium albidum*, *Trillium grandiflorum*, *Polygonatum biflorum*, *Vagnera racemosa*, and *Hepatica acutiloba*. This vernal display is by far the most dense of any for there is little shade in the forest when these plants bloom. They generally die down after blooming and a few weeks later no trace of them may be seen above ground. The second cycle is composed chiefly of broad, thin-leaved shade plants. Here are found *Aralia nudicaulis*, *Geranium robertianum*, *Geum rivale*, and *Ranunculus abortivus*. The third cycle is composed of a fall flora many members of which are composites such as species of *Aster* and *Solidago*.

Only one or two virgin forests now remain because of burning or lumbering. However many of the destroyed areas are now being reforested.

* The work upon which this paper is based was done at the Biological Station of the University of Michigan under the direction of Professor Frank C. Gates.

† Gleason, H. A. The structure of the Maple-Beech Association in Northern Michigan. Papers Mich. Acad. Sci. Arts & Letters, 4: 285-296. 1924.

AREAS STUDIED

A study was made of two virgin forests and eleven areas which are being reforested. A short description will be given of each followed by a table summarizing the species.

On a clay moranic ridge 4 km. west of Pellston is Area A, a virgin beech-maple forest. This was a part of the original virgin forest when white men first entered the country and it is maintaining itself perfectly. The chief trees are *Acer saccharum*, *Fagus grandifolia*, and *Ulmus americana*. There are several hemlock knolls where the shade is greater. Because of fallen trees there is a good deal of sunlight in certain places, resulting in a great variety of ground plants and shrubs.

Area B is a virgin beech-maple forest near areas 5, 6, and 7. The principal trees observed were *Acer saccharum*, *Betula lutea*, *Fagus grandifolia*, *Fraxinus americana*, *Tilia glabra*, *Tsuga canadensis*, and *Ulmus americana*. Many of these trees are very large. The soil is very rich and the humus-leaf cover is about 20 cm. in depth. Parts of this area are low, and here more lowland forms are found. Abundance of seedlings insures indefinite repetition of the forest unless man interferes.

Various areas which were once beech-maple forests (locally called hardwoods) and have been disturbed by fire, lumbering, or cutting, were examined to determine the nature of the reforestation. The drainage and soil of these areas are good, and the topography rolling.

About 0.8 km. west of Bryant's Hotel on a slope was a beech-maple forest known as Bryant's Hardwoods (area 1). This was lumbered in the winter of 1911-1912, and in 1914 it was covered with *Epilobium angustifolium*. From 1917 until 1920 every indication showed that this region would be typically aspen. However by 1921 small beeches and maples began to become dominant. The aspen association was nipped in the bud although many ground plants are still characteristic of the aspen association. Now the trees are almost entirely *Fagus grandifolia*, *Acer saccharum*, and *Acer rubrum*. These trees are less than ten years of age and show every indication of vigorous growth and spread.

About 0.2 km. from Douglas Lake at North Fishtail Bay on a slope toward the lake is an area known as North Fishtail Hardwoods (area 2). In 1915 it was a fine beech-maple forest.

Since then, part of it has been burnt over twice, the second burning being in 1919. Every indication points to the fact that the beech-maple will remain here unless disturbed by fire.

In an area about 1.6 km. north of Sedge Point there was a beech-maple climax forest which was lumbered in 1912-1915 (area 3). In the three years following, coppicing began, but in 1919 a forest fire swept all of the area. The area is now used as pasture, and presents an irregular checker board appearance of miniature forest practically unmolested and grass and weed covered ground between. In the future as the trees grow higher they are expected to shade out the grass and completely re-establish the beech-maple forest.

North of area 3 is the remnant of a second growth beech-maple forest (area 4). There is a leaf-humus cover varying from 2.5-10 cm. in depth over most of the ground. This area was partially lumbered in 1919-1920 but many large trees over twenty years in age remain. There are many open spaces in which pioneer plants abound. Although this area has been pastured, if left undisturbed as it now is, the present reproduction of maple will tend to bring it back to its former state.

About 1.5 km. southwest of Mud Lake is a tract of ground which was once entirely covered by a virgin beech-maple forest (areas 5, 6, 7) in which three sets were studied showing different stages of coppice development. Part of this tract (area B) is still covered by a virgin forest, but the rest has been cleared and a portion allowed to revert to forest. These areas are becoming typical second growth beech-maple forests.

Northeast of Riggsville about 2.5 km. is an area covered by a second growth beech-maple forest (area 8). This is a remnant of a larger forest but the territory surrounding it has been cleared and is now being farmed. If this area is left undisturbed, it will become a typical beech-maple forest.

At Riggsville Corners (area 9) there is a second growth hardwood area with trees of 30-35 years of age. It has been pastured somewhat and subjected to ground fires. It is now a typical beech-maple forest in so far as the trees are concerned, and the ground plants are becoming so in the absence of pasturing, during the last few years.

Back of North Woods Camp near Bogardus Point is a second growth beech-maple forest (area 10). This has been undisturbed

by fire or cutting for at least twenty-five years. Because of the proximity to the lake, the situation is a well drained one but is somewhat lower and more moist than any of the other areas studied. The tree species include not only the typical beech-maple trees but also a great deal of *Tsuga canadensis* mostly 24-25 years old. Some *Pinus strobus* seedlings were observed but these were not growing well.

In addition to the studies made near Douglas Lake, a small area about 100 × 650 m. located in the State Game Refuge in Emmet County was observed (area 11). It is at the base of an old dune and is completely surrounded by a coniferous forest. The future development of this little area is promising for it represents a comparatively recent invasion by the beech-maple forest into a piney area. Spread from this nucleus is to be expected.

RESULTS

As a result of tree counts and quadrat counting the following table shows a comparison between the tree composition of the virgin beech-maple forests of the region and that of the reforesting areas studied.

TREE COMPOSITION OF THE BEECH-MAPLE FOREST

	Percent in typical beech- maple forest*	Per cent in reforesting areas studied
Normal Species		
<i>Acer rubrum</i>	3.7	1.7
<i>Acer saccharum</i>	35.9	67.3
<i>Betula lutea</i>	4.1	.9
<i>Fagus grandifolia</i>	21.2	6.8
<i>Fraxinus americana</i>	.8	X†
<i>Ostrya virginiana</i>	1.4	.9
<i>Tilia glabra</i>	2.1	.6
<i>Tsuga americana</i>	14.6	2.7
<i>Ulmus americana</i>	2.9	1.5
	86.7	82.4
Prominent Relics		
<i>Betula papyrifera</i>	1.4	4.0
<i>Pinus strobus</i>	1.5	0.0
<i>Quercus borealis</i>	0.7	X†
	90.3	86.4

* Tree count from 18,000 trees. Data from F. C. Gates.

† Found out of quadrat line, so not figuring in the calculation.

Trees not in the Mature Beech-Maple Forest

<i>Abies balsamea</i>	0	2.4
<i>Populus grandidentata</i>	0	2.8
<i>Populus tremuloides</i>	0	1.0
<i>Prunus pennsylvanica</i>	0	1.6
		94.2

In the following table, the ground plants found in the reforesting areas are grouped together according to their average frequency index, and type of vegetation. Some plants had a very high frequency index in one area and practically none in the other areas, while others were about equal in each area.

GROUND PLANTS IN REFORESTING AREAS

Average Frequency Index above 10

(Species typical of beech-maple forests are starred)

* <i>Acer saccharum</i> (seedlings)	59	* <i>Aralia nudicaulis</i>	14
<i>Rubus strigosus</i>	18	* <i>Osmorrhiza claytoni</i>	14
* <i>Trillium grandiflorum</i>	17	* <i>Trientalis americana</i>	13
<i>Unifolium canadense</i>	16	<i>Poa pratensis</i>	11

Average Frequency Index between 5-10

Seedlings of Trees

* <i>Acer pennsylvanicum</i>	* <i>Fagus grandifolia</i>
<i>Acer rubrum</i>	

Shrubs

<i>Diervilla lonicera</i>	* <i>Sambucus racemosa</i>
---------------------------	----------------------------

Herbs

<i>Fragaria virginiana</i>	<i>Taraxacum vulgare</i>
<i>Lactuca canadensis</i>	* <i>Vagnera racemosa</i>
* <i>Mitchella repens</i>	* <i>Viola canadensis</i>
<i>Poa compressa</i>	* <i>Viola papilionacea</i>
* <i>Polygonatum biflorum</i>	

Average Frequency Index between 1-5

Seedlings of trees

<i>Abies balsamea</i>	<i>Prunus pennsylvanica</i>
<i>Betula papyrifera</i>	<i>Tsuga canadensis</i>
<i>Populus tacamahaca</i>	* <i>Ulmus americana</i>
<i>Populus tremuloides</i>	

Shrubs

<i>Acer spicatum</i>	<i>Rubus allegheniensis</i>
* <i>Lonicera canadensis</i>	<i>Rubus triflorus</i>
<i>Prunus virginiana</i>	<i>Taxus canadensis</i>
<i>Rhus glabra borealis</i>	

Herbs or creeping plants

* <i>Actaea alba</i>	* <i>Galium triflorum</i>
<i>Antennaria canadensis</i>	<i>Gaultheria procumbens</i>
* <i>Arisaema triphyllum</i>	* <i>Geranium robertianum</i>
<i>Aster laevis</i>	* <i>Hepatica acutiloba</i>
* <i>Botrychium virginianum</i>	<i>Lycopodium annotinum</i>
<i>Carex umbellata</i>	* <i>Lycopodium lucidulum</i>
<i>Cerastium vulgatum</i>	* <i>Osmorrhiza longistylis</i>
<i>Chimaphila umbellata</i>	<i>Rumex acetosella</i>
<i>Clintonia borealis</i>	<i>Solidago canadensis</i>
* <i>Dryopteris cristata</i>	<i>Vagnera stellata</i>
* <i>Dryopteris spinulosa</i>	<i>Verbascum thapsus</i>

The following are characteristic of typical beech-maple forests but their Frequency Indices were less than 1% or they did not appear in any quadrat in the reforesting areas: Tree: *Prunus serotina*; Shrub: *Ribes cynosbati*; Liana: *Celastrus scandens*; Herbs: *Adiantum pedatum*, *Agrimonia gryposepala*, *Allium tricoccum*, *Aster macrophyllus*, *Bicuculla canadensis*, *Bicuculla cucullaria*, *Carex albursina*, *Carex arctata*, *Chenopodium capitatum*, *Corallorrhiza maculata*, *Cynoglossum officinale*, *Erythronium albidum*, *Galium circaezans*, *Lappula deflexa*, *Medeola virginiana*, *Melica striata*, *Milium effusum*, *Monotropa uniflora*, *Pyrola elliptica*, *Streptopus roseus*, *Tiarella cordifolia*, *Uvularia grandiflora*, *Viburnum acerifolium*, and *Viola eriocarpa*.

REFORESTATION IN DISTURBED AREAS STUDIED

A. *Fire*. Many of the reforesting areas studied have been burnt over. There are two types of fires, (1) ground fires which damage only part of the trees and are local, and (2) fires sweeping everything and killing all the trees and ground plants and destroying accumulated humus.

The succession the first few years after a fire is very similar in all areas. Pioneer ground plants, often lichens like *Cladonia rangiferina*, or, if low ground, liverworts like *Marchantia polymorpha*. *Epilobium angustifolium* often follows this lichen or liverwort stage and is followed by aspens and associated ground plants. This association is characterized by quickly growing, short-lived, sun-loving trees, and sun-loving ground plants, many of which have rootstocks.

From this point the succession goes one of two ways. (1) The aspen stage may become completely developed and from that

go to beech-maple; or (2) if the fire is not too severe as the aspens start to develop, stump sprouting from the burned maples nips the aspen stage in the bud and the area reverts to beech-maple.

B. *Lumbering*. Conditions are radically different where the areas have been lumbered. If the lumbering has been complete, the first year or so afterwards finds some aspen species entering the area and the beech-maple ground plants, seedlings and shrubs dying out from exposure to the sun. Then the stumps of *Acer saccharum* begin to sprout. These coppices soon become very thick. As the shoots grow larger they shade out aspens, and provide sufficient shade for beech-maple ground plants. Then as they grow taller and more dense the shade increases until very few ground plants and seedlings are found. As the trees grow they crowd out the weaker species. This thinning out process continues and more shade plants and beech and other seedlings enter and it becomes a typical beech-maple forest.

C. *Pasturing*. Many of the areas have been or are being pastured. Pasturing does not destroy the forest immediately, of course, but changes the character of the undergrowth and destroys a large percentage of young seedlings, so the future of the forest is endangered. Maples however are somewhat distasteful and so are not readily eaten by cattle. Areas 1, 2, 3, 4, were all burned over about the same time and now *Acer saccharum* has a frequency index of 39.9 in area 1 and 33.6 in area 2. Neither of these have been pastured, and have a variety of other trees. Areas 3 and 4 however have been pastured and *Acer saccharum* has a frequency index of 90 in area 3 and 87.8 in area 4. The presence of certain species not natural in a beech-maple forest always indicates pasturing. Some of these species are *Poa pratensis*, *Poa compressa*, *Phleum pratense*, and *Trifolium repens*. If an area which has been pastured is left undisturbed for a few years, the normal ground plants return, and seedlings of maple and beech again are found.

D. *Abandoned Cultivated Land*. If any of the areas are cultivated for a time after clearing, and are later abandoned, the succession is quite long and involved. First is found a weed stage, a meadow stage and then stages of native ground plants, shrubs and trees to the climax beech-maple forest.*

* Gates, Frank C. Plant Successions about Douglas Lake, Cheboygan County, Michigan. Bot. Gaz. 82: 170-182. 1926.

SUMMARY

1. Many well-drained ridges in the Douglas Lake region, Cheboygan County, Michigan, are occupied by virgin beech-maple forests unless this forest has been destroyed by fire, lumbering, or clearing.

2. A typical beech-maple forest is characterized by trees of *Acer saccharum*, *Fagus grandifolia*, *Betula lutea*, *Tilia glabra*, *Acer rubrum*, *Ulmus americana*, and *Ostrya virginiana*. In some of the forests *Tsuga canadensis* may be quite abundant. Shrubs are few and there are about 35 typical ground plants almost always present in beech-maple forests together with some ground plants found in several habitats. Many individuals in this ground cover are seedlings.

3. The reforestation of beech-maple forests in 11 areas was studied during 1926 by the quadrat method.

4. Lumbered areas without fire return to beech-maple by means of coppice development. Burnt areas usually involved fireweed and other stages and take longer. Pastured areas are still more involved and greatly favor the sugar maple (*Acer saccharum*) at the expense of other species. In abandoned cultivated areas, the succession includes weed and meadow stages before the usual stages to the climax beech-maple forest.

KANSAS STATE AGRICULTURAL COLLEGE,
MANHATTAN, KANSAS.

TWO NEW SPECIES OF PORTULACA FROM
MEXICO

PERCY WILSON

✓ *Portulaca Conzattii* P. Wilson, sp. nov.

A rather slender, erect, annual herb, 1.5-3 dm. tall, with slender roots, and tufts of long white hairs in the axils of the leaves; leaves alternate, the blades flat, lanceolate, obovate, or oblanceolate, 1.5-2.7 cm. long, 2.5-4.5 mm. broad, obtuse or acutish at the apex; flowers terminal, in clusters of 2 or 3 surrounded with long white hairs and an involucre of 8 or more leaves; calyx-lobes triangular-orbicular, 5 mm. long, 6.5 mm. wide; corolla yellow, the lobes obovate or elliptic-obovate, 7-8 mm. long, 3-3.5 mm. broad; stamens about 20; style-lobes 4 or